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MONITORING BEAKED WHALE RESPONSES TO SONAR TESTS AT THE ATLANTIC UNDERSEA TEST AND EVALUATION CENTER (AUTEC)

by

Diane Claridge and Charlotte Dunn

November 2011

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This report was prepared by:

Diane Claridge
Bahamas Marine Mammal
Research Organisation

Charlotte Dunn
Bahamas Marine Mammal
Research Organisation

Reviewed by:

Jeffrey Paduan
Chairman, Department of Oceanography

Released by:

Karl Van Bibber
Vice President and Dean of Research

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833 Dyer Road,
Monterey, CA 93943-5122

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14. ABSTRACT

As part of an overall project to monitor beaked whales and other odontocete cetaceans at the Atlantic Undersea Test and Evaluation Center (AUTEC) using photo-identification methods to contribute to the assessment of possible population-level effects of frequent exposure to sonar, such monitoring was performed from April to May 2011 at the Weapons Range of AUTEC. Although no beaked whales were encountered, there were ten other cetacean sightings during this time, including three sperm and two short-finned pilot whale sightings. During the latter two sightings, eight and seven, respectively, biopsies were collected. A total of 1236 photographs were taken. Initial analysis of the sperm whale identification photographs indicates that none matched any in the existing catalogue of sperm whales from the northern Bahamas.

15. SUBJECT TERMS

AUTEC, beaked whales, Cuvier's beaked whale, Blainville's beaked whale, sperm whale, pilot whale, melon-headed whale, photo-identification, sonar exposure.

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MONITORING BEAKED WHALE RESPONSES TO SONAR TESTS AT THE ATLANTIC UNDERSEA TEST AND EVALUATION CENTER (AUTEC)

Grant Number: N00244-11-1-0021
Final Technical Report
October 31, 2011

Diane Claridge, Charlotte Dunn
Bahamas Marine Mammal Research Organisation (BMMRO)

In collaboration with:

David Moretti
Naval Undersea Warfare Center (NUWC)

Background

Atypical mass strandings of beaked whales have coincided with a number of Navy sonar exercises (Cox *et al.* 2006), highlighting a vulnerability of these species to anthropogenic noise. The two species of whale most commonly involved in these strandings, Cuvier's beaked whale and Blainville's beaked whale, regularly dive to >1000 m and for >1 hour (Tyack *et al.* 2006), making them difficult to locate and therefore study. However, Blainville's beaked whales are reliably detected and observed in the deep water canyons of the northern Bahamas (Claridge and Durban 2009), including the Tongue of the Ocean east of Andros Island (Figure 1a), site of the US Navy's Atlantic Test and Evaluation Center (AUTEC). The AUTEC Weapons Range is a 1500-km^2 area used for fleet readiness training, where sonars are used regularly (DiMarzio *et al.* 2008).

In this study we are using photo-identification methods to monitor cetacean species of concern at the AUTEC Weapons Range. This work will build on photo-identification data that has already been collected at AUTEC from Blainville's beaked whales (*Mesoplodon densirostris*), Cuvier's beaked whales (*Ziphius cavirostris*), sperm whales (*Physeter macrocephalus*), pilot whales (*Globicephala macrorhynchus*) and melon-headed whales (*Peponocephala electra*), and will increase sample sizes to contribute to the assessment of population level effects of frequent sonar exposures.

Objective

To monitor beaked whales and other odontocete cetaceans at AUTEC using photo-identification methods to contribute to the assessment of possible population-level effects of frequent exposure to sonar.

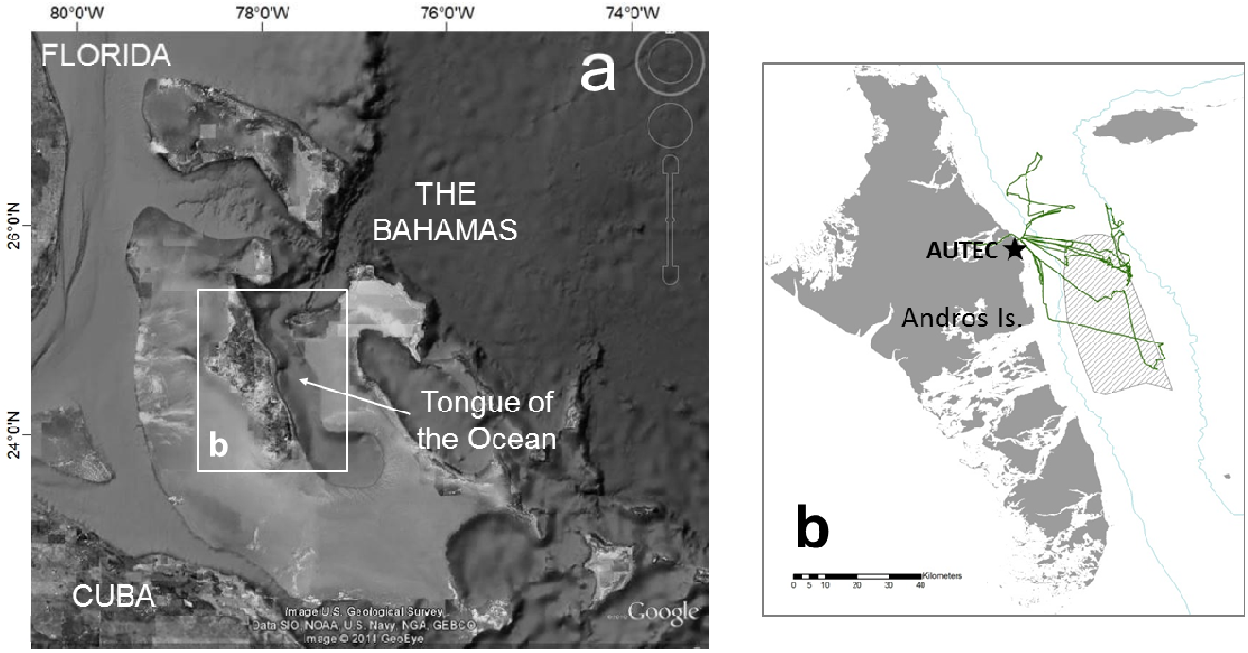

Figure 1. **(a)** Map (created using Google Earth) of the Bahamas showing the Tongue of the Ocean, site of the US Navy's Atlantic Undersea Test and Evaluation Center (AUTEC), where field work was conducted. **(b)** Vessel tracks (in green) show survey efforts off AUTEC during April and May 2011. The 1000 m isobaths (blue lines) and the outer boundary of the instrumented hydrophone array at AUTEC's Weapons Range (hatched area) are shown.

Approach

Using an array of bottom-mounted hydrophones at AUTEC's Weapons Range, beaked whales and other odontocetes can be monitored and localized in real time by passive acoustic detection of their echolocation clicks (DiMarzio *et al.* 2008). Acoustic technicians from the Naval Undersea Warfare Center relayed real-time cetacean localizations using the marine mammal monitoring system at AUTEC (Moretti *et al.* 2006) and vectored observers on a 6.8 m rigid-hulled inflatable (RHIB) to the vocalizing whales, increasing the opportunities for locating animals and data collection. When approaching whales, the vessel was manoeuvred alongside the group and digital SLR Nikon cameras were used with either a fixed 300 mm F4 lens or 80-200 mm F2.8 zoom lens to photograph all individuals within a group, whenever possible. If high quality photographs are obtained, Blainville's beaked whales can readily be distinguished individually by natural markings and can be tracked/monitored over long time periods (Figure 2).

Figure 2. Photographic matches of a female Blainville's beaked whale show evidence of longevity of natural scarring patterns. Oval marks are scars from bites attributed to cookie cutter sharks (*Isistius* spp.).

Work Completed

The research team was based at AUTEC from 23 April to 7 May 2011. Unfortunately, efforts were hampered by inclement weather, and also by restrictions in gaining access to the Weapons Range because of range safety concerns. As a result, vessel surveys were possible for only six of thirteen days that the field team was on site (Figure 1b). The team maximized effort as best they could and covered 714 km of vessel track line, totaling 46.4 hours of visual search effort (Table 1). However, during these days conditions were still sub-optimal for locating and closely approaching beaked whales.

Table 1. Summary of field efforts and sightings at AUTEC during April-May 2011.

DATE	EFFORT (KM)	EFFORT (HR)	SPECIES SEEN	GROUP SIZE	DUR. (MIN)	NO. BIOPSIES
24-Apr-11	38	3.6	none	n/a	n/a	0
27-Apr-11	40	3.4	none	n/a	n/a	0
30-Apr-11	167	9.1	Short-finned pilot whale	22	69	5
04-May-11	172	9.9	Sperm whale	1	130	1
			Short-finned pilot whale	11	43	2
05-May-11	172	9.3	Sperm whale	9	109	2
			Melon-headed whale	40	22	0
			Pygmy sperm whale	2	1	0
06-May-11	125	11.1	Sperm whale	9	430	5
			Melon-headed whale	25	47	0
			Melon-headed whale	2	1	0
			Fraser's dolphin	3	32	0

Results

From 24 April – 6 May, there were 10 cetacean sightings at AUTEC, but none of beaked whales (Figure 3). This was due to sea states being higher than Beaufort 3 on all days except one, and we were not allowed access to the Weapons Range on that particular day. In total, we spent 14.7 hours with animals, during which time 1236 photographs were taken. There were 3 sperm whale and 2 short-finned pilot whale sightings on the Weapons Range, during which sightings we collected 8 and 7 biopsy samples, respectively. These will contribute to population genetics and investigations into diet as part of the Strategic Environmental Research and Development Program (SERDP) funded Behavioral Ecology Study of Deep-diving Odontocetes.

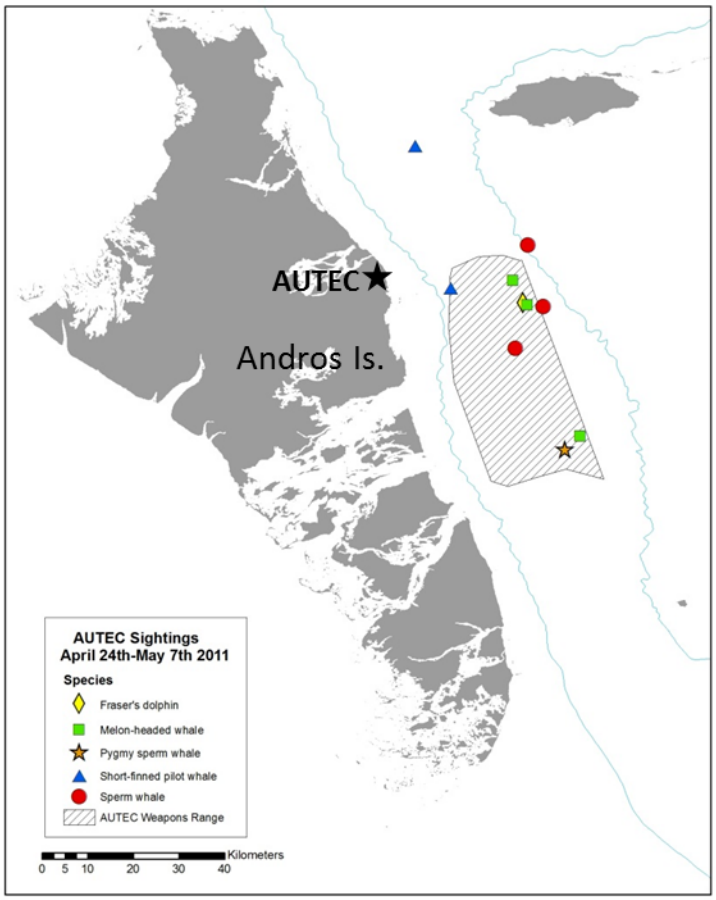

Figure 3. Map of the northern Bahamas showing locations where photographic data and biopsy samples were collected on the AUTEC Weapons Range. A group of short-finned pilot whales was sighted well north of the range during a time when range access was denied to the research team. The 1000 m isobaths are shown by the blue lines.

Preliminary matching has been completed for the sperm whale identification photographs. We found that, with the exception of one possible match (Pm079), all of the animals did not match our existing catalogue of more than 180 sperm whales from the northern Bahamas, and are thus considered "new" animals in the area.

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